U.S. DEPARTMENT OF ENERGY

Salt Waste Processing Facility

SWPF Process and Liquid Waste Interface Overview

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December 9, 2015

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Salt Waste Processing Facility

PARSONS

Parsons is the contractor for the SWPF project
(design, construct, commission and operate for one year)

This essential facility will:

- Reduce radioactive waste volume requiring vitrification
- Utilize the same actinide and cesium removal unit processes as Interim Salt Processing Facilities (ARP/MCU)
- Process over 90% of Tank Farm liquid radioactive waste (97 Mgal. after dissolution)
- Have a nominal capacity of 6 – 9 million gallons per year

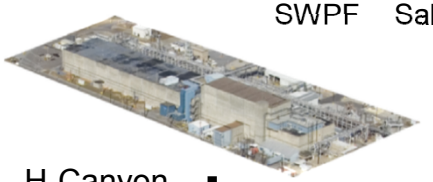
Liquid Waste System Today

Legend:

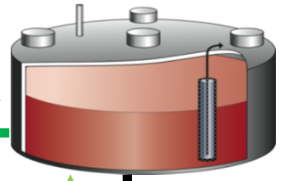
ARP	Actinide Removal Process
DWPF	Defense Waste Processing Facility
MCU	Modular Caustic Side Solvent Extraction Unit
SWPF	Salt Waste Processing Facility

SWPF

- ✓ Designed to Process more than 6 millions gallons per year
- ✓ Cs Decontamination factor > 40,000
- ✓ Technology is very mature
- ✓ No open DNFSB issues



H-Canyon Receipts



SWPF (under construction)

Salt Waste

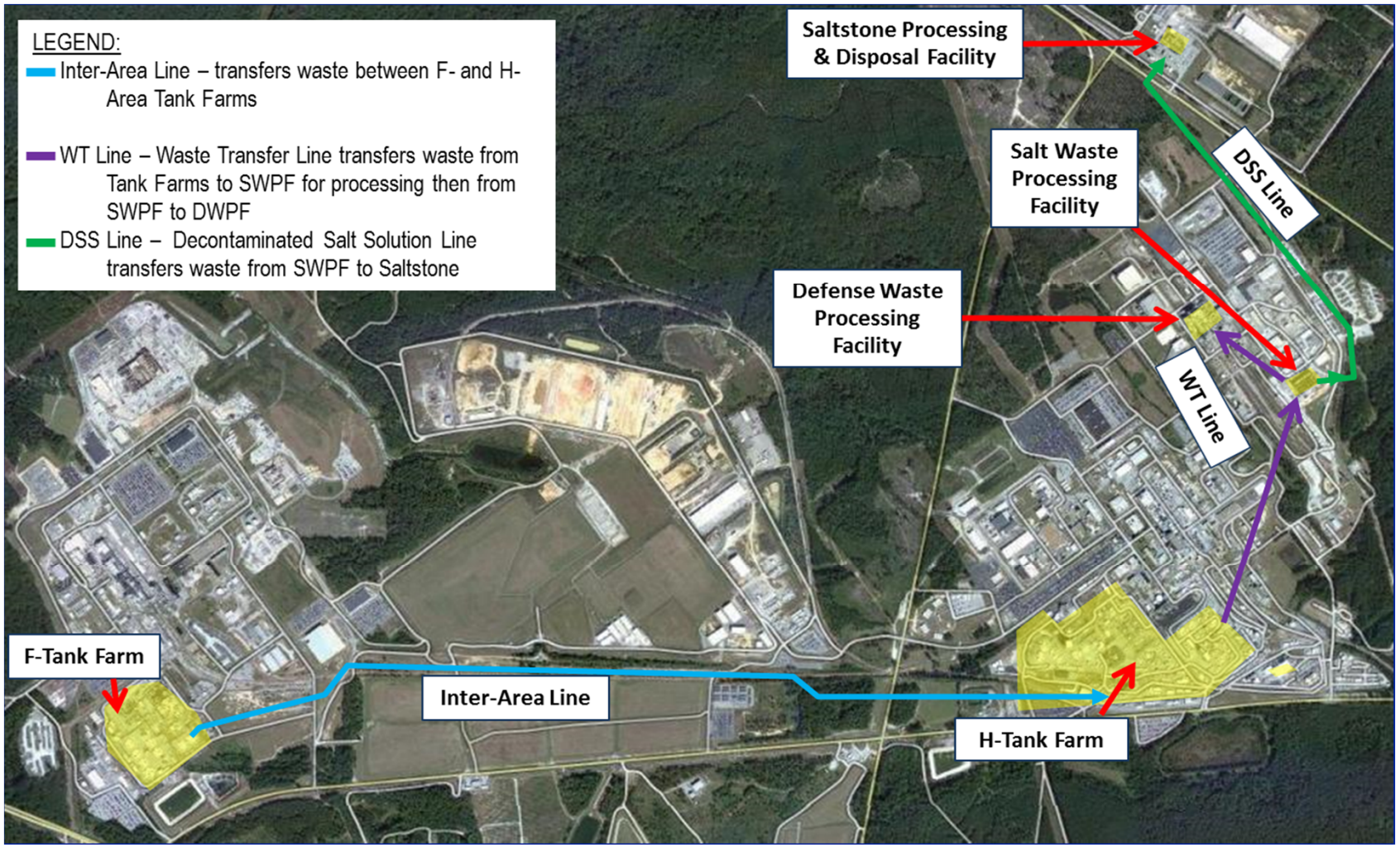
Recycle

Sludge Waste

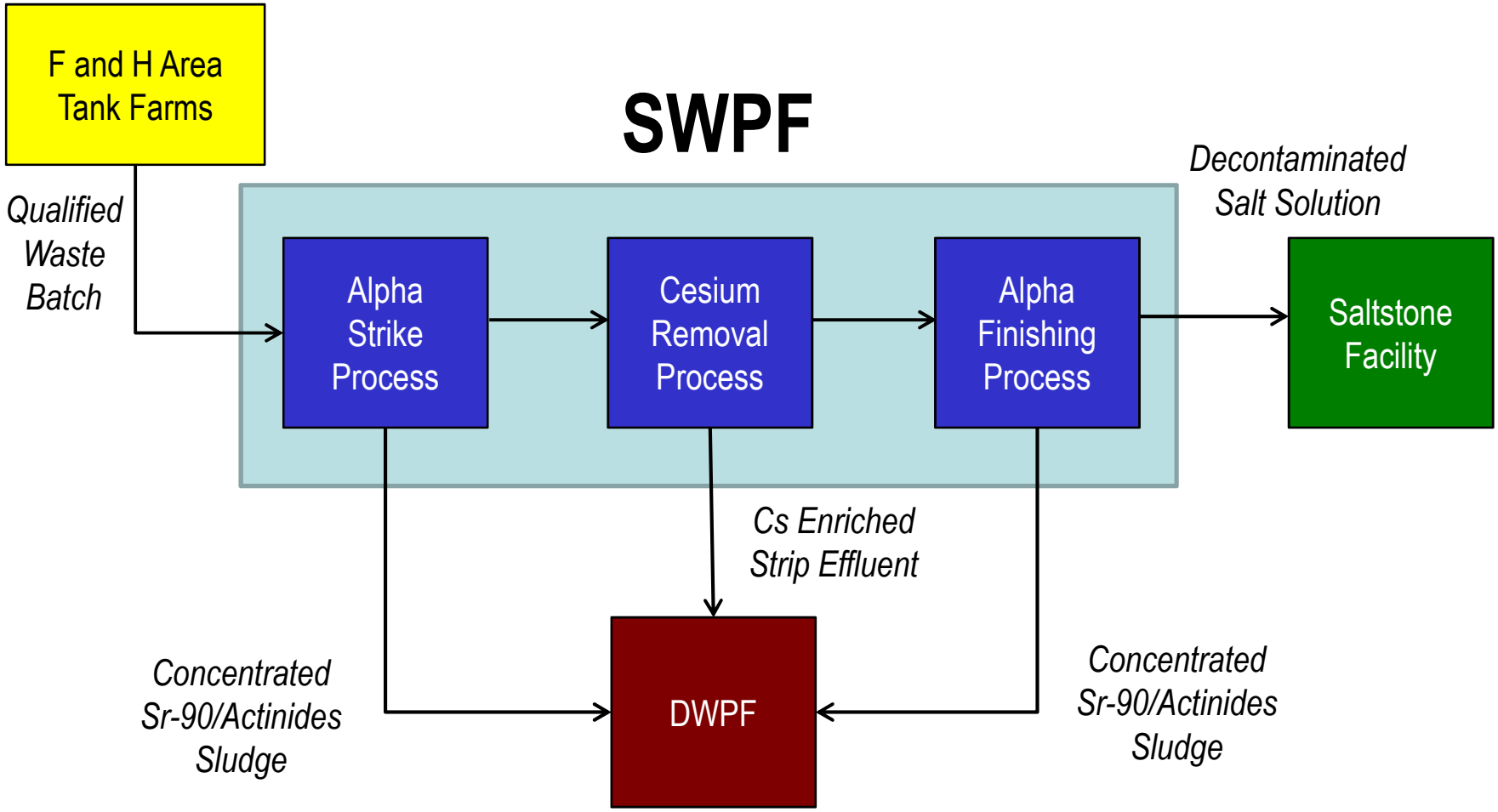
Radionuclides

Inert chemicals

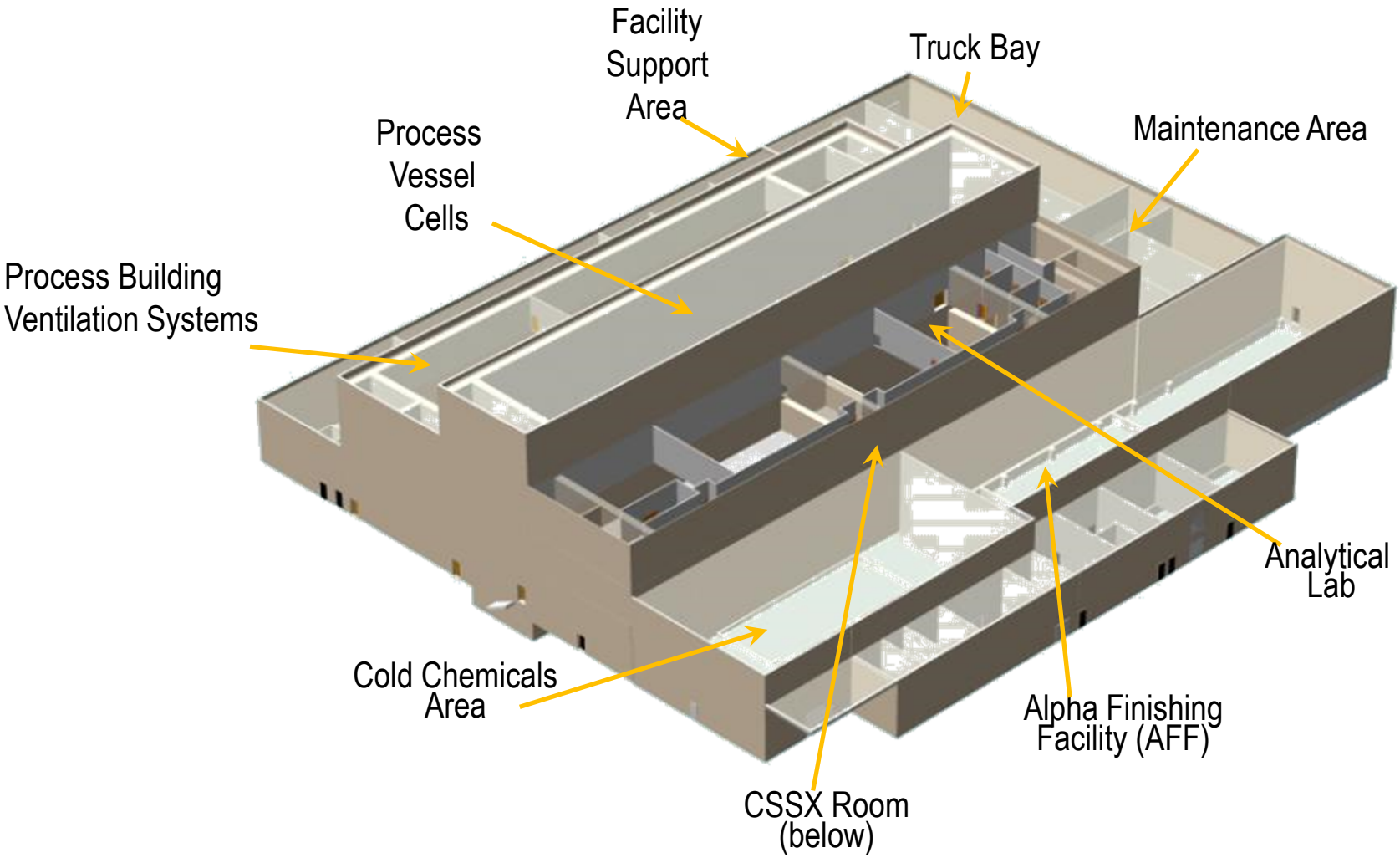
Waste Transfers



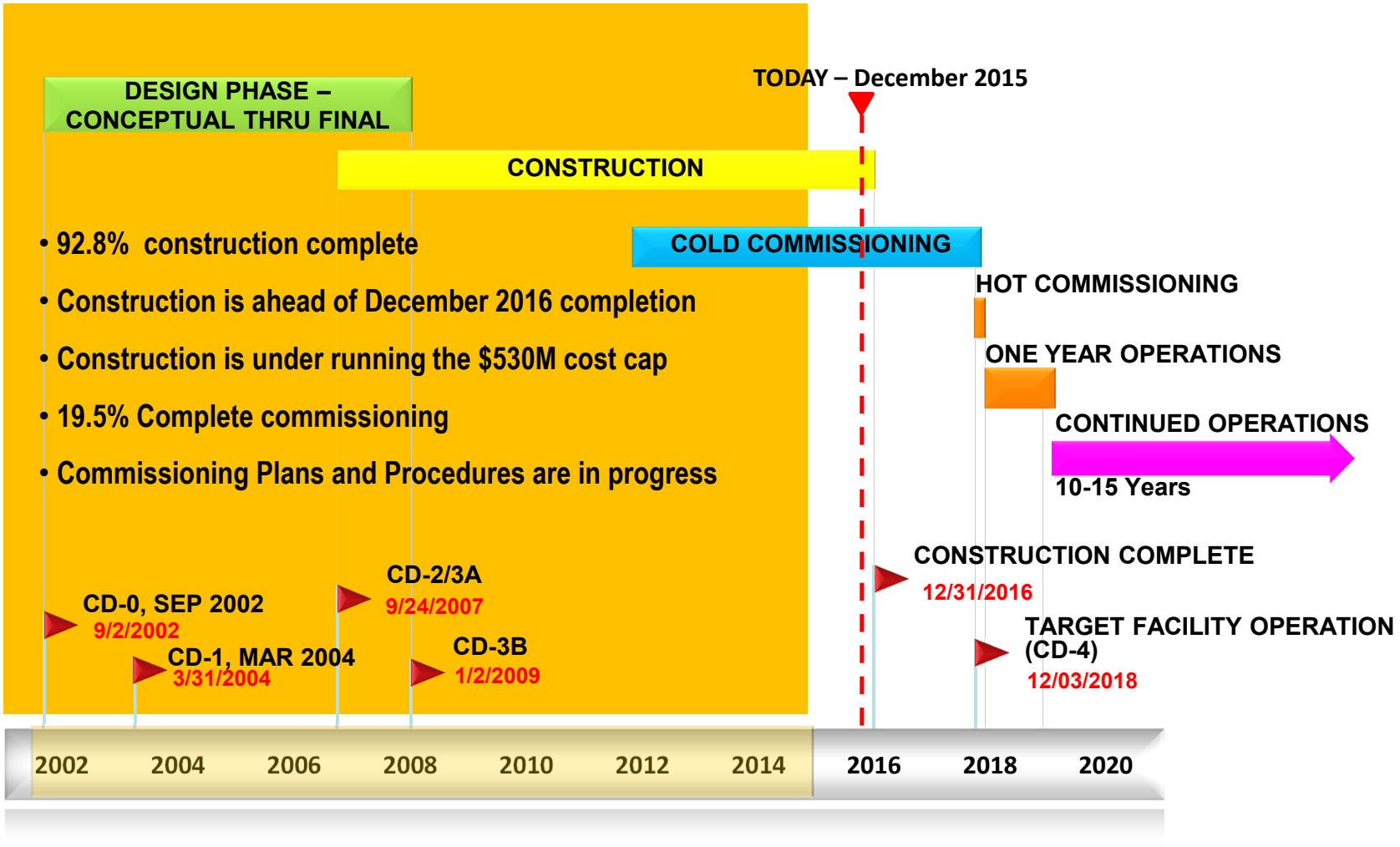
SWPF Process



SWPF Process Building Layout



SWPF Project Milestones



SWPF Construction Progress

Basemat Installed

- Performance Category 3 (PC-3)
- 8-feet thick
- 32,943 square feet
- 10,032 cubic yards

First Story Under Construction

- Walls to 100 ft. elev. Completed
- Began installation of process piping
- Wall placement to 139 ft. elev. in progress
- Successful installation of contactor modules
- Dark cells fabricated

Vessel Placement

- Successful installation of
- 10 large ASME Vessels
- 150,000 gal. of tank volume in CPA
- PC-1 support structures underway

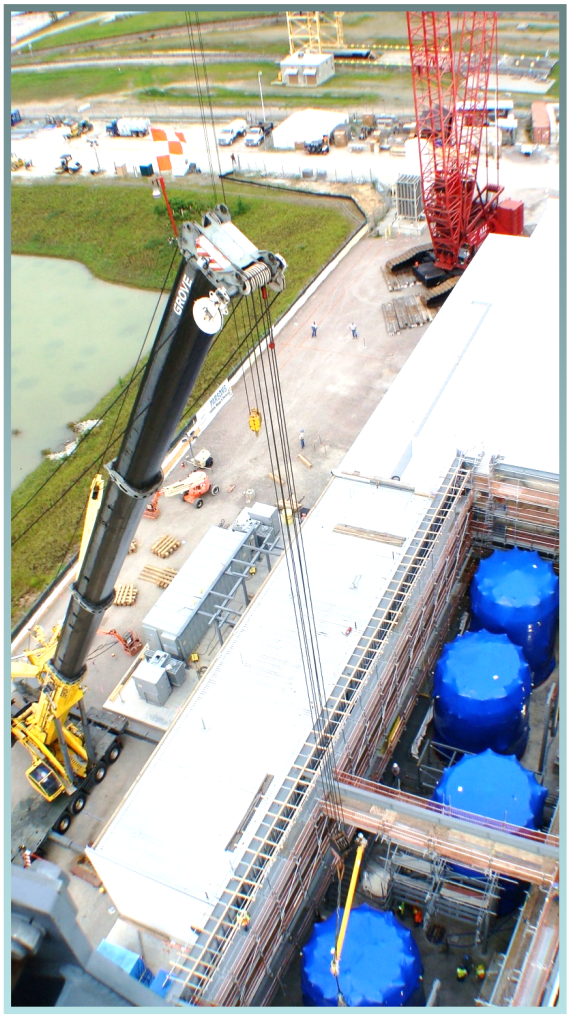
TODAY – 92.8% Physical Completion

- Roof completed
- HVAC 92% complete
- Ventilation stack completed
- Fire coatings complete
- Transformers and switchgear in place
- All major process equipment in place
- Waste transfer line installation complete
- 100,000+ LF of piping installed (87% complete)
- 83,000 welds made (93% complete)
- 120,000 LF of conduit installed (85% complete)
- 380,000 LF of wire and cable installed (60% complete)

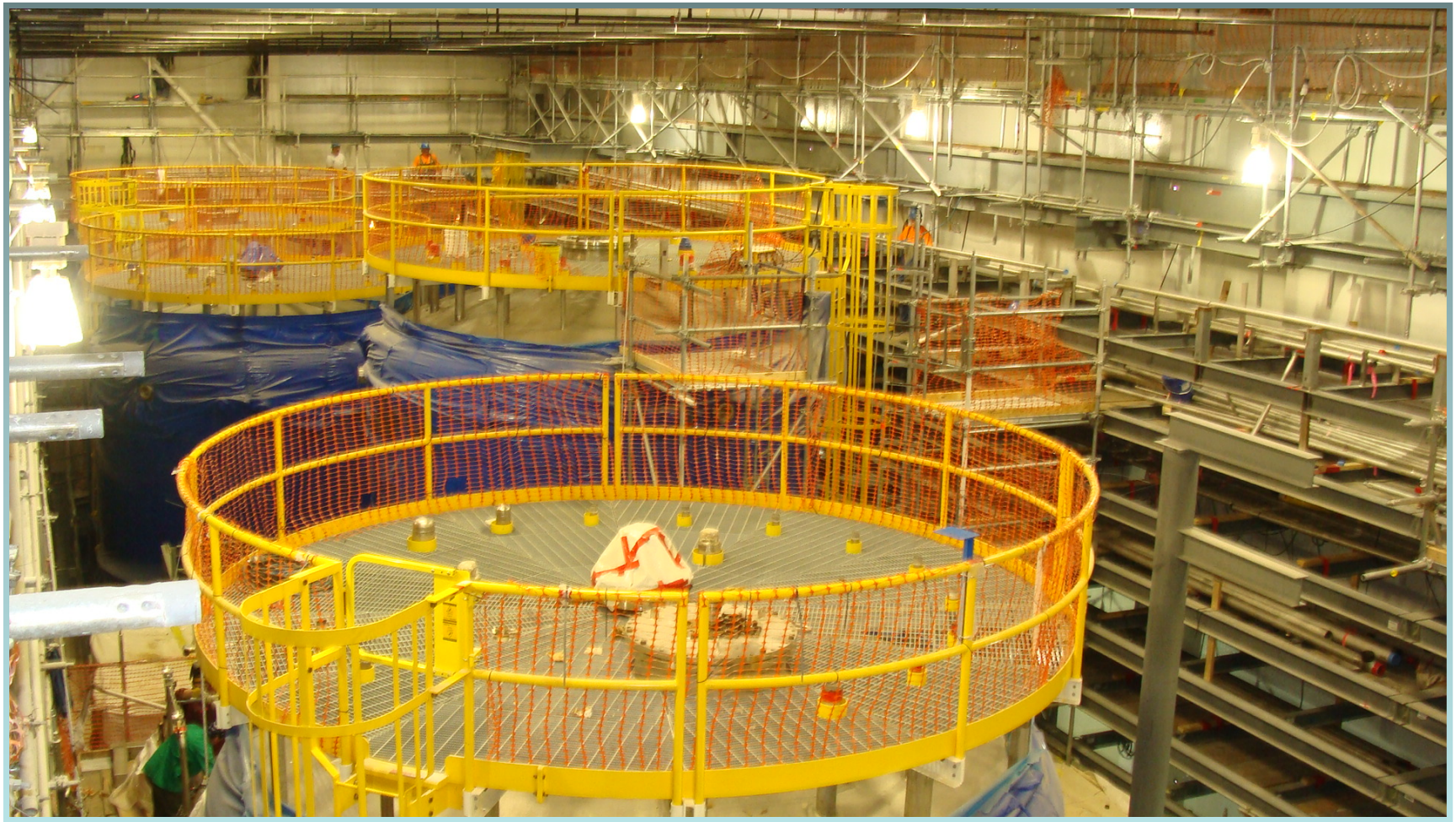
Projected Construction Completion Date – April 2016

Cesium Removal Contactors Arrival and Installation (December 2010)

Large ASME Vessels Delivered (June/July 2012)



Alpha Finishing Tanks (December 2013)

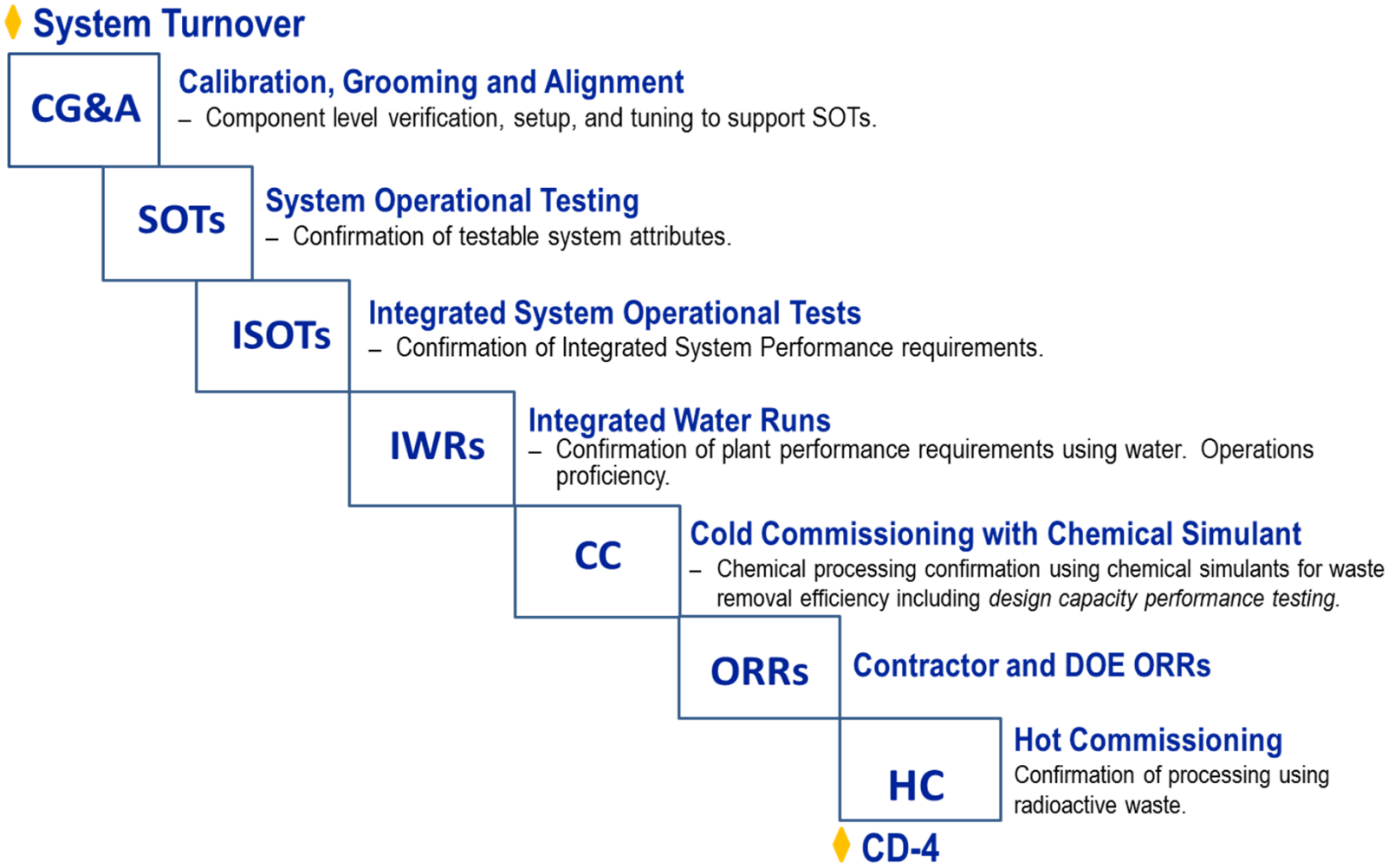


Waste Transfer Line Installation (April 2014)

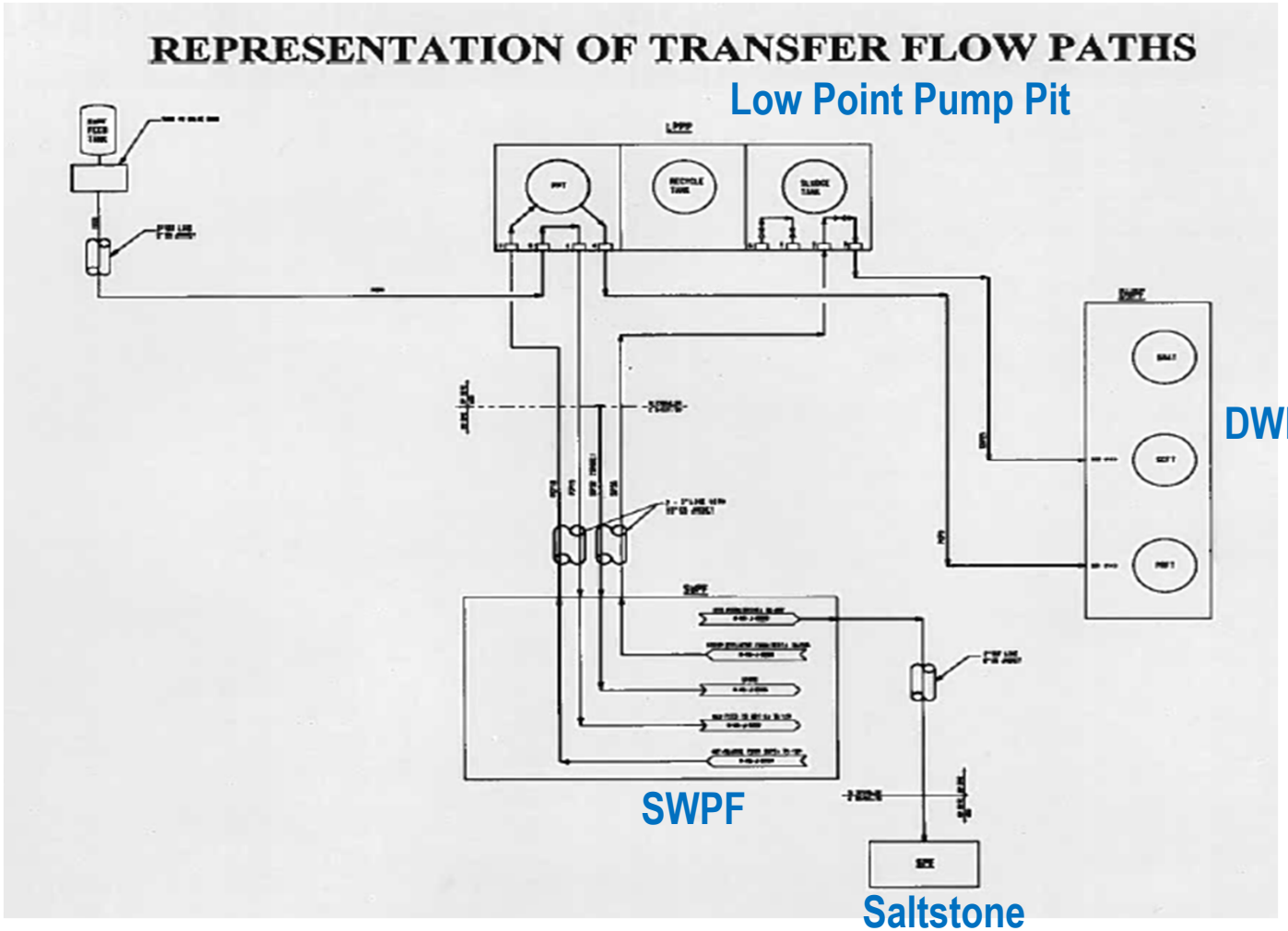
SWPF Test Program

- Extensive Test Program - Demonstrated Process Met or Exceeded 100% Capacity
- Robust Operating Envelope Developed to Provide Flexibility of Operations
- On-going Tests – Reliability/Maintainability – Increase Throughput

SWPF Testing Activities



Liquid Waste Interface Lines



SWPF Main Process

ASP

Adsorbed Sr and actinides onto MST.

MST concentrated by CFFs

Concentrated sludge is washed to remove [Na+] prior to transfer to the DWPF.

CSSX

Extracts and concentrate Cs from the aqueous CFF filtrate (CSS).

The resulting aqueous solution (DSS) is transferred to the SPF.

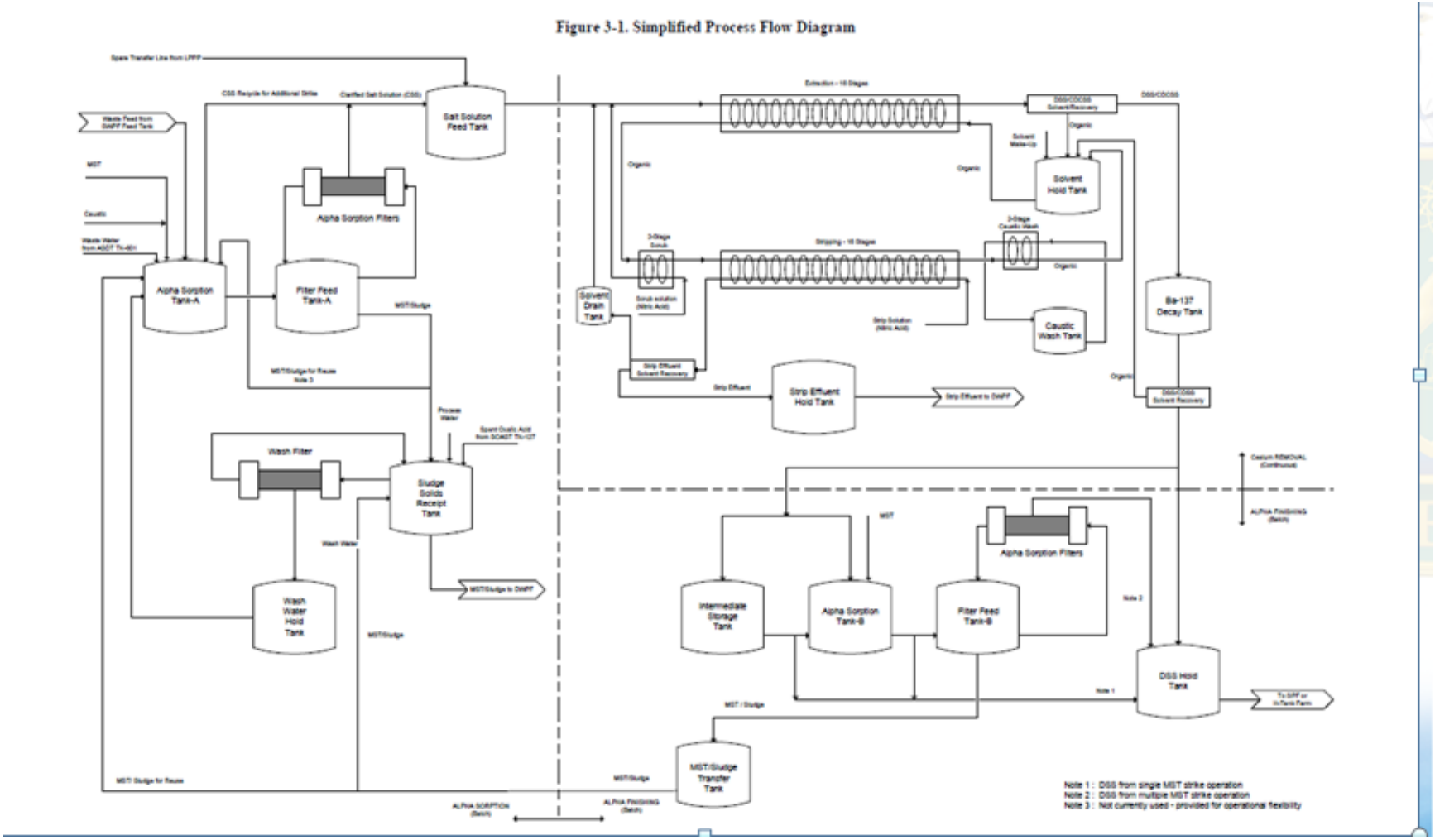
Concentrated Cs is transferred to the DWPF.

AFP

Similar to the ASP, the MST is used to sorb selected actinides and Sr.

This process will be used on waste batches when a further reduction in the radionuclide concentrations in the DSS is required.

Summary Flow Diagram



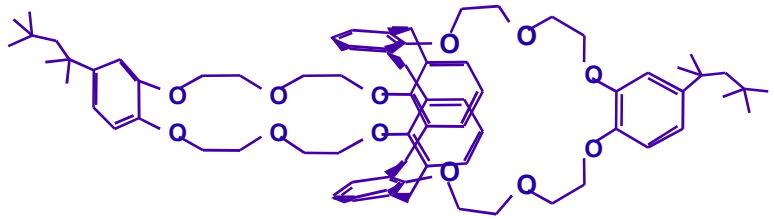
Suspended Solids Samples (Cross Flow Filtration)

Figure 1: HLW Sludge Solids Slurries

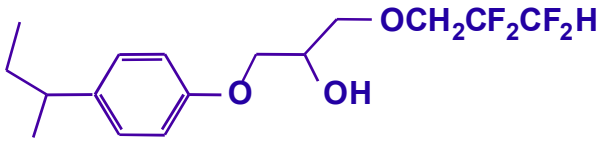
WSRC-TR-2005-00161, C. J. Martino

Transmitted light through 30 mL aliquots of simulated sludge.

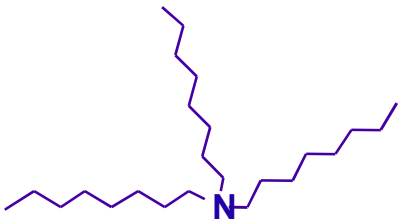
Solvent Components



Extractant
Calix[4]arene-bis(*tert*-octylbenzo-crown-6)
"BoBCalixC6"
0.007 M



Modifier:
1-(2,2,3,3-tetrafluoropropoxy)-3-(4-*sec*-butylphenoxy)-2-propanol
"Cs-7SB"
0.75 M

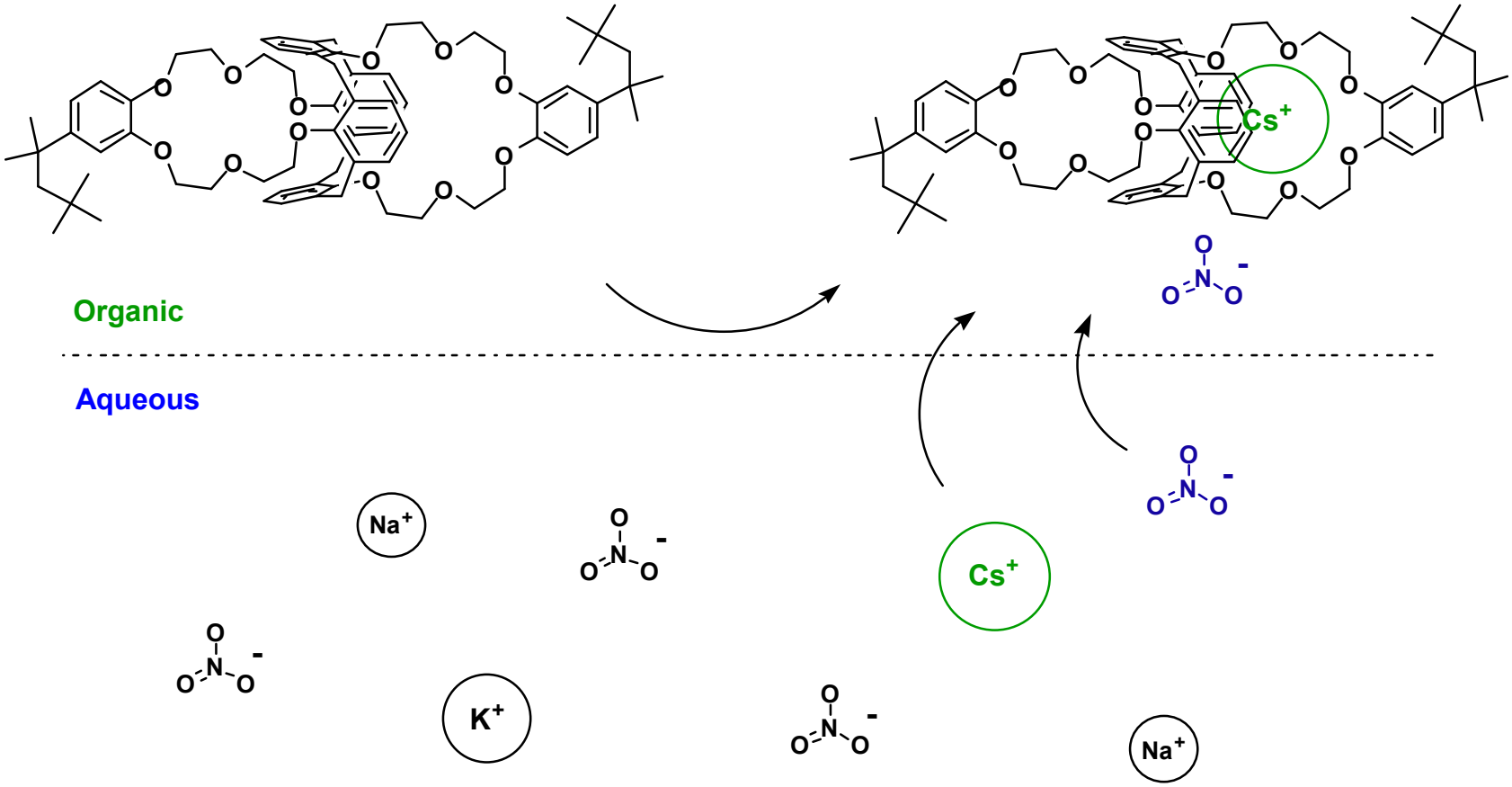


Suppressor
Tri-n-octylamine
"TOA"
0.003 M

Diluent
Isopar® L
(a blend of C10-C12 branched alkanes)

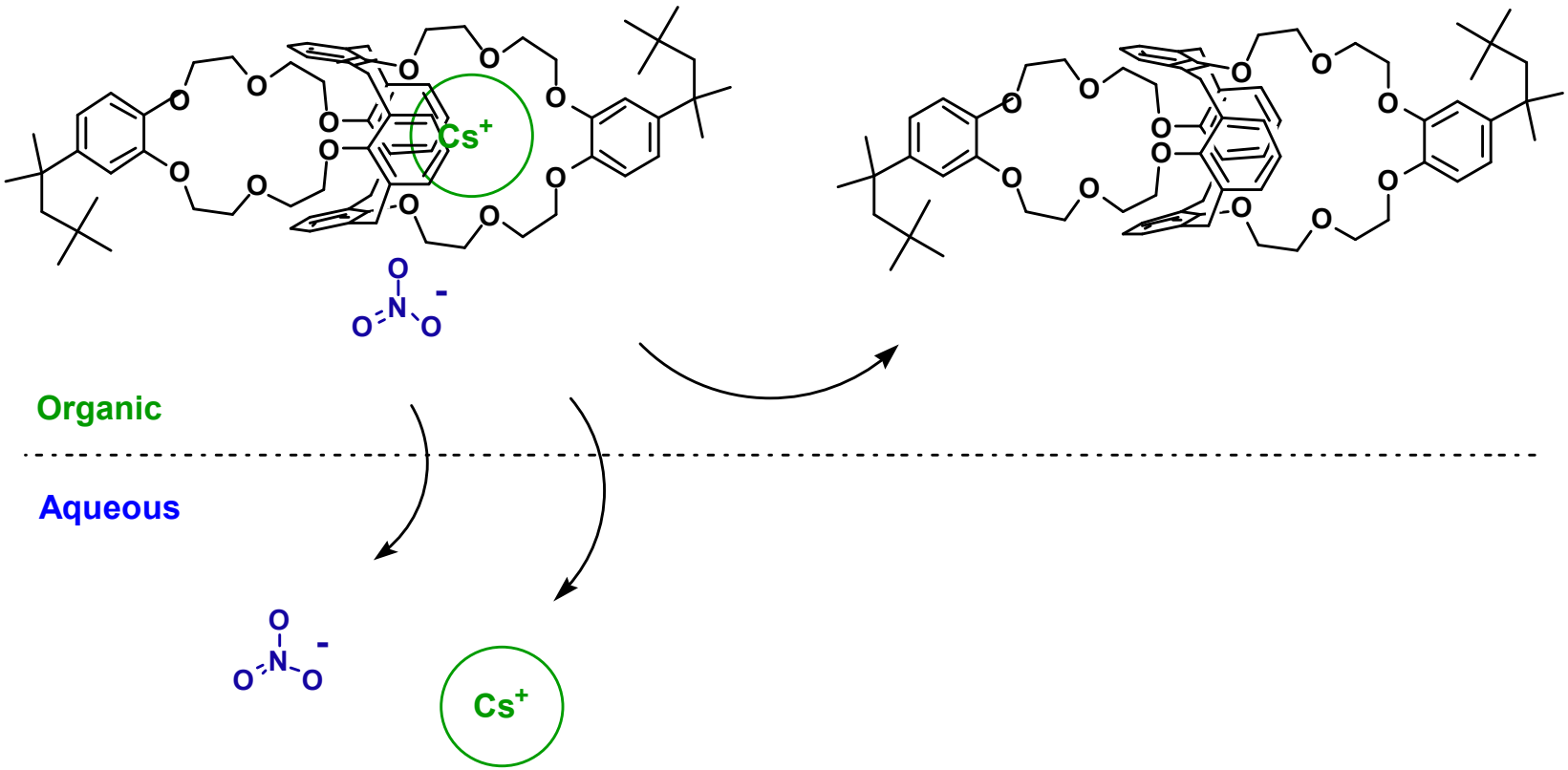
BOBCalixC6 Selectively Extracts Cs+ Ion

A major reaction involves extraction of CsNO3 as an ion pair. Modeling shows that actual mechanism also involves other reactions.

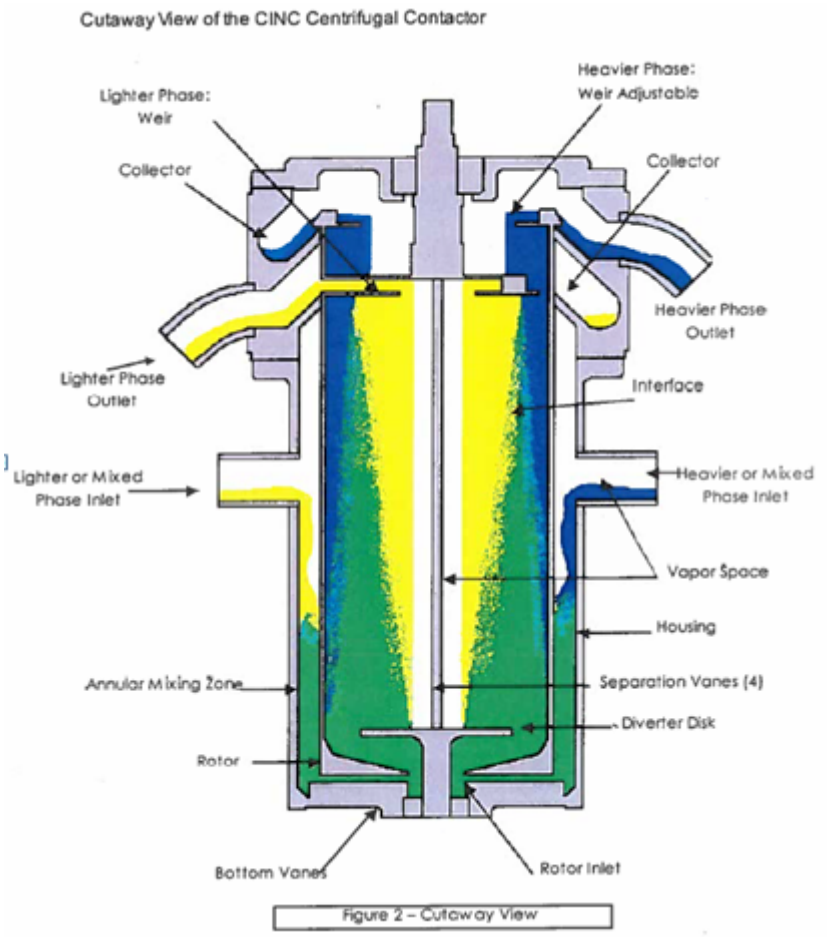


Water Stripping is Key to the CSSX Process

Produces a highly purified product
Excellent feed for vitrification in the DWPF

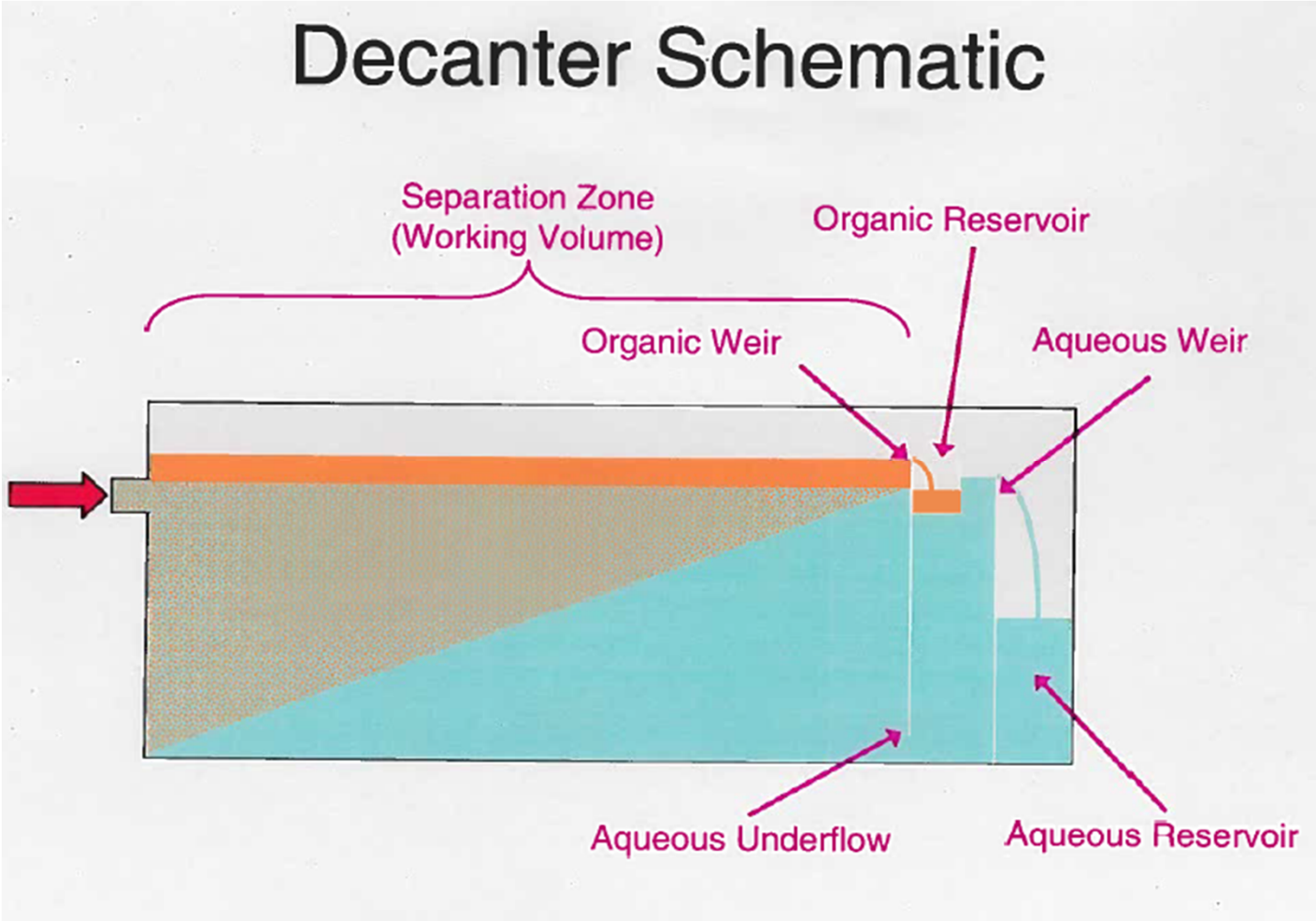


CINC Standard Contactor

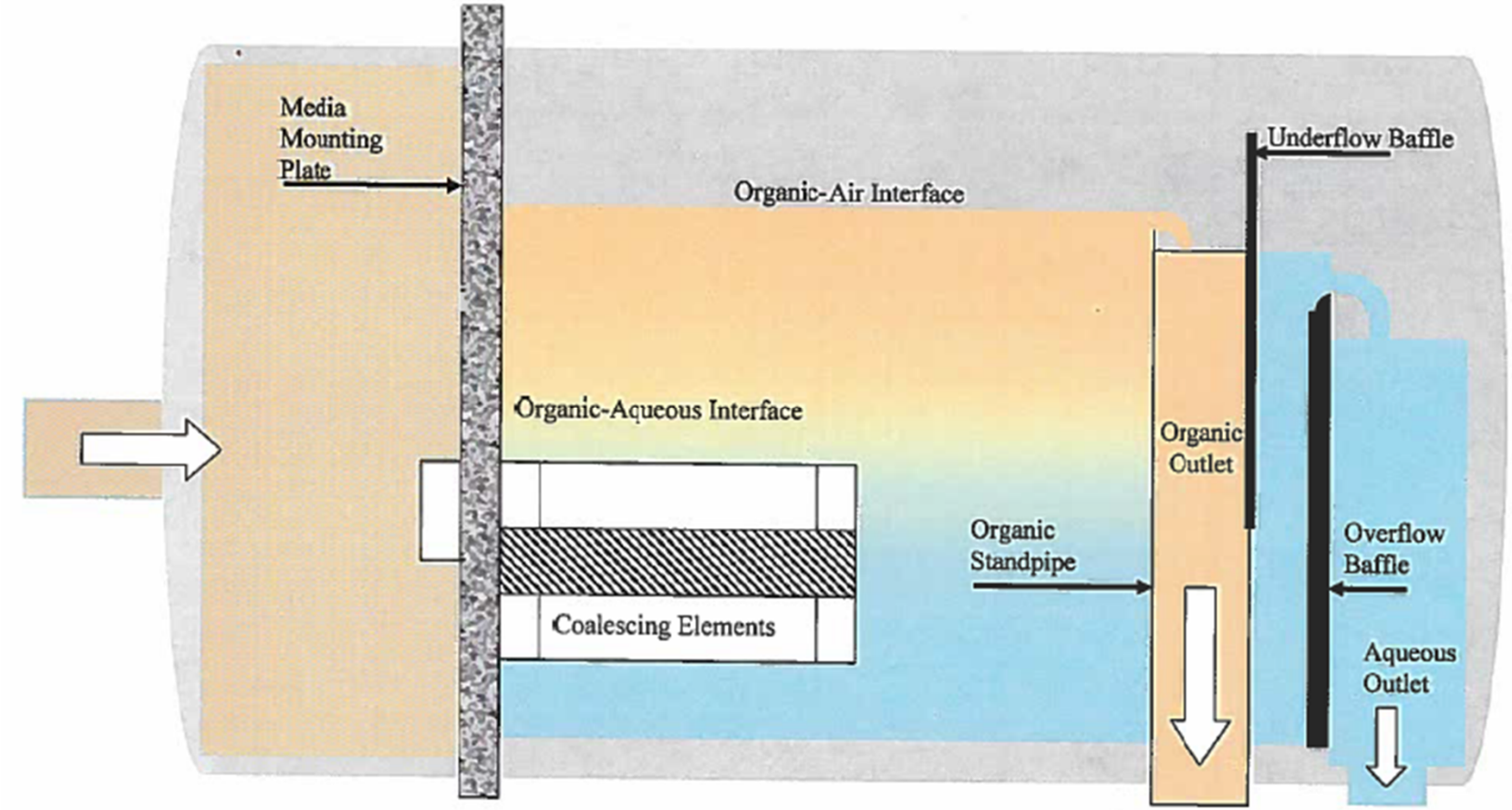


Installation of a contactor at the Salt Waste Processing Facility

Stilling Tank/Decanter



Coalescer


Media
Mounting
Plate
Organic-Air Interface
Underflow Baffle
Organic-Aqueous Interface
Organic
Outlet
Organic
Standpipe
Overflow
Baffle
Coalescing Elements
Aqueous
Outlet

Looking to the Future

- High degree of technical confidence
- Maintain safety, cost and schedule performance
- Integrate NGS and High Sodium processing to enhance throughput
- Optimize facility operability
- Maintain integration with the Liquid Waste Program
- Minimize Liquid Waste lifecycle costs – Full Solution to SRS Tank Closure

Backup

Target ion [ ]'s for the Salt Solution Simulant and Chemical Reconstitution

Table 5-1 - Target Ion Concentrations for 5.6M and 6.44M [Na^+] Salt Solution Simulants

Ionic Species	Concentration for 5.6M [Na^+] (M)	Concentration for 6.44M [Na^+] (M)
Sodium (Na^+)	5.58E+00	6.42E+00
Potassium (K^+)	1.50E-02	1.80E-02
Nitrate (NO_3^-)	1.82E+00	2.19E+00
Cesium (Cs^+)**	4.30E-04	5.16E-04
Chlorine (Cl^-)	2.45E-02	2.94E-02
Hydroxide (OH^-)*	3.19E+00	3.54E+00
Nitrite (NO_2^-)	5.00E-01	6.00E-01
Aluminum (Al^{3+})	2.08E-01	2.50E-01
Carbonate (CO_3^{2-})	1.50E-01	1.80E-01
Sulfate (SO_4^{2-})	1.40E-01	1.68E-01
Oxalate ($C_2O_4^{2-}$)	8.00E-03	9.61E-03
Silicon oxide (SiO_3^{2-})	2.50E-02	3.00E-02
Molybdite (MoO_4^{2-})	7.86E-05	9.44E-05
Copper (Cu^{4+})	2.22E-05	2.67E-05
Zinc (Zn^{2+})	1.24E-04	1.49E-04
Iron (Fe^{3+})	2.55E-05	3.06E-05
Tin (Sn^{2+})	1.99E-05	2.39E-05
Fluorine (F^-)	2.80E-02	3.36E-02
Monohydrogen phosphate (HPO_4^{2-})	7.00E-03	8.41E-03
Strontium (Sr^{2+})**	1.06E-04	1.27E-04

* The OH^- concentration specified is the target amount added to the simulant. The actual free hydroxide concentration is expected to be lower as a result of secondary reactions, particularly with aluminum nitrate.

** For those batches requiring DF demonstration

Chemical Reconstitution Options

- Full reconstitution to the target concentrations for 5.6M [Na+] - (table 5-1)
- Reconstitution of major components only (NaOH, Sodium Nitrate, Sodium Nitrite)
- Reuse of a simulant batch without reconstitution
- A combination of the previous options